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I.

Social and Respiratory Behavior of Large Tarpon.

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(Text-figure 1).

INTRODUCTION.

This report is in the nature of a continuation of the studies of Schlaifer & Breder (1940) and was made incidental to other work to be reported elsewhere. For these latter purposes five tarpon were confined in a pen built of slats 13'2" \times 7'0" \times 5'8" deep. This was submerged in the artificial channel serving as a means of egress from Palmetto Key, Florida. The five fish averaged about five feet in standard length. The smallest, estimated at four feet in length, was a male in a ripe condition; the remaining four were females that were nearly ripe. They were caught and placed in the pen by Marshall B. Bishop late in May. The counts on their rises for respiratory purposes began on June 11 as given in Table I. In this the writer was assisted by Mr. Ben Dontzin who made readings Nos. 10 to 22. One reading was made simultaneously with a similar reading in the tarpon pool described in Schlaifer & Breder (1940). It is noted in Table I as P1. Since these authors have already described the respiratory behavior of immature and small tarpon it was thought desirable that some comparable measurements be made on the adult, sexually mature individuals.

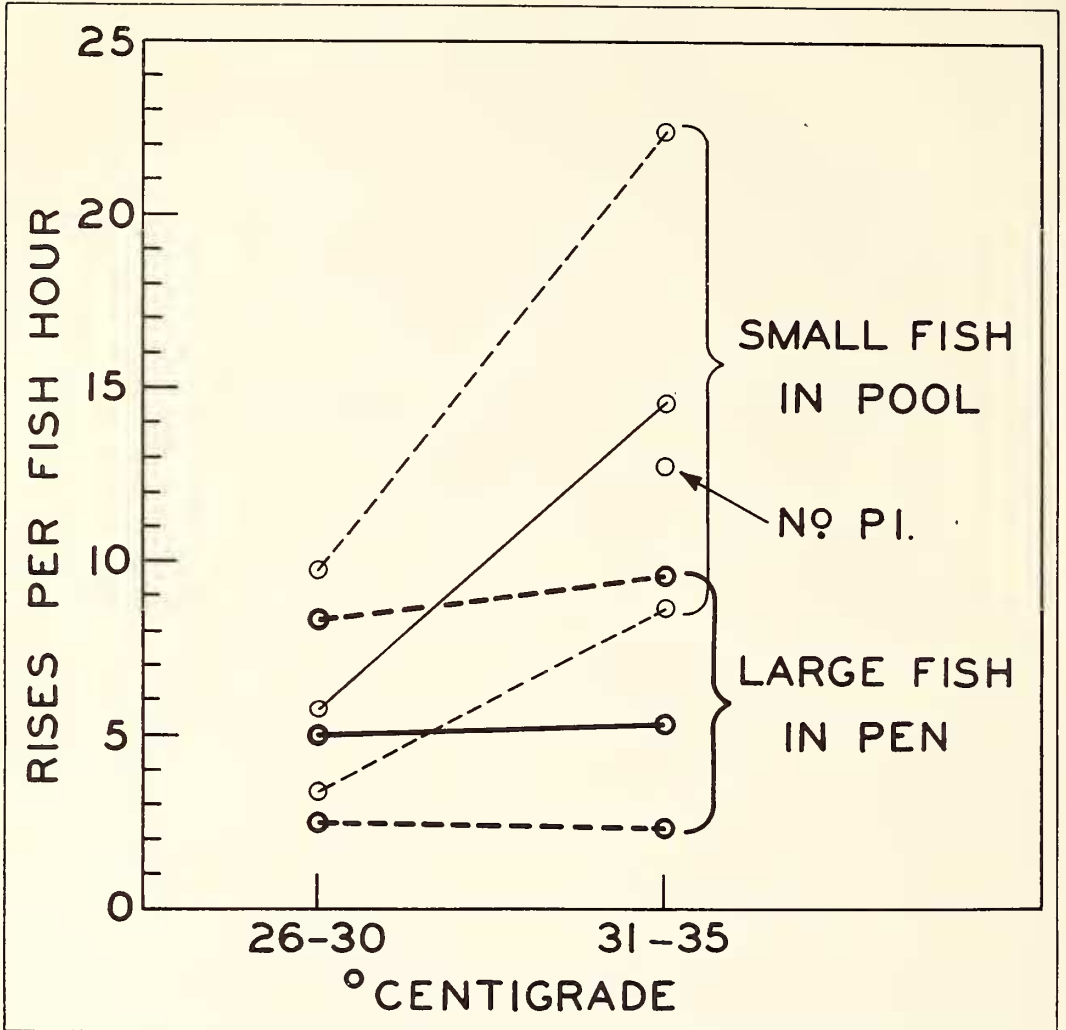
The methods employed have already been set forth by Schlaifer & Breder (1940), and Schlaifer (1941) has shown that atmospheric respiration is obligatory on this species.

RESULTS.

The results obtained are clearly comparable with those gotten on the smaller fish. There are certain noteworthy differences, however, which include chiefly that the fishes of these larger sizes do not rise with quite the frequency of the smaller speci-

mens. If the number of rises per hour is referred to the temperature range, Table II, and compared with the earlier data on smaller fishes, it will be noted that in the 26°-30° range the figures are almost identical but slightly lower for the larger fish, while in the 31°-35° range the larger fish are definitely much lower than the smaller. This may well have to do with the environment rather than the size of fish. The large fish were held in a pen through which circulated tidal waters, whereas the small fish were confined to a stagnant pool in which gaseous exchange occurred only through the air-water interface as there was no continuous replacement by flow. A comparison of these data are given in Text-figure 1.

It is evident from observations in both Boca Grande and Captiva Passes that tarpon tend to rise for air in groups. This social aspect of the respiratory need for air was discussed at length for the smaller sizes by Schlaifer & Breder (1940). Similar data for large fish in a pen, handled in identical fashion, is given in Table III. It will be noted that here there is relatively little social influence being shown. It is much less than the average shown for small fish in various-sized bodies of water. These authors found that the larger the body of water the less the imitation, presumably due to the greater chance separation of the fishes. On this basis the present large fish should show a marked amount of imitation. That they showed less suggests the presence of some other factor. It is to be noted that the social attitude of the small fish in the pool (P1) is comparable to readings taken in it a year earlier and not with the large penned fish. These fish were approaching the spawning condition which well may have an effect on their social attitude. Later it was found on examination



Text-fig. 1. Comparison of respiratory activity of large and small tarpon showing both means and extremes. Data on small fish from Schlaifer & Breder (1940).

that these fish were actually reabsorbing their eggs under the apparent influence of captivity. They were, for their size, relatively closely confined, but not any more so than the small fish studied in aquaria which showed the greatest amount of imitation.

A more detailed comparison of this influence in large and small tarpon is impossible for the present as the effects of temperature and oxygen content at least would have to be much better understood before an attempted explanation of the effect on respiration of absolute size of fish or its condition in regard to spawning time could be ascertained.

As may be noted from Table I, the variation in respiratory activity was marked by abrupt changes in rises per hour that could

not be associated with temperature, time of day or any other ascertainable influence.

As a further continuation of the work of Schlaifer & Breder (1940) observations were made on a single tarpon of 35.6 cm. in standard length in the laboratory pool. These data were taken by Mr. Ben Dontzin. Condensed, they appear as follows:

Date	Time	°C	Rises per hour
12/26/41	5:00 p.m.	—	2
12/27/41	11:15 a.m.	26.5	2
12/27/41	5:15 p.m.	23.5	4
12/28/41	10:45 a.m.	27.0	1
12/29/41	11:10 a.m.	29.0	6
12/30/41	1:15 p.m.	26.0	5

Each period of observation continued for an hour beginning with the time indicated.

The data is presented as in Table VII of Schlaifer & Breder (1940). It agrees well with their work and in reference to their temperature comparisons stands as follows:

Temperature in 5° intervals centigrade.		
Rises per fish hour	21-25	26-30
Present data		
Mean	4	3.5
Maximum	—	6
Minimum	—	1
Schlaifer & Breder (1940)		
Mean	4.8	5.7
Maximum	10.4	9.6
Minimum	1.6	3.3

It thus develops that this single fish rose to breathe with slightly less frequency than did those in the larger groups (3 to 5) previ-

ously studied. This is in keeping with expectation on a social basis. Although this data is scant it can, in reference to the earlier work, be considered as confirmatory. The pool contained a large number of small *Mugil* which were not present during the earlier work, but which apparently have little if any effect on respiratory behavior.

REFERENCES.

- SHLAIFER, A. & BREDER, C. M., JR.
1940. Social and Respiratory Behavior of Small Tarpon. *Zoologica*, 25(30): 493-512.
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1941. Additional Social and Physiological Aspects of Respiratory Behavior in Small Tarpon. *Zoologica*, 26(11): 55-60.

TABLE I.

Respiratory Activity of Adult Tarpon in Confinement.

(5 mature fish in a live car). (One hour observation periods).								
No.	Date	Time	°C	Rises	Rises per Fish Hour	Greatest Time Between Rises	% of Minutes with no Rises	
							All	Per Fish
1	6/11	1:45	33.8	18	3.6	5:33	70.0	14.0
2	6/12	2:00	33.8	16	3.2	6:03	73.3	14.6
3	6/13	6:15	32.9	42	8.4	4:40	48.3	9.6
4	6/14	1:45	33.6	30	6.0	4:02	58.3	11.6
5	6/14	7:00	32.2	29	5.8	6:26	61.6	12.3
6	6/15	2:30	33.6	36	7.2	3:23	48.3	9.6
7	6/17	1:30	33.8	23	4.6	6:29	65.0	13.0
8	6/18	1:30	31.1	18	3.6	5:13	71.6	14.3
9	6/24	1:45	31.7	20	4.0	8:30	73.3	14.6
10	6/25	10:00	31.1	40	8.0	4:02	53.3	10.6
11	6/25	2:00	32.9	12	2.4	8:39	81.6	16.3
12	6/25	6:30	31.7	24	4.8	6:50	68.3	13.6
13	6/26	10:30	31.7	47	9.4	4:42	51.6	10.3
14	6/26	2:00	33.8	18	3.6	6:44	70.0	14.0
15	6/26	6:45	32.2	18	3.6	7:29	63.3	12.6
16	6/27	11:30	31.1	46	9.2	4:37	50.0	10.0
17	6/27	7:00	30.0	21	4.2	5:47	68.3	15.6
18	6/29	10:00	30.0	41	8.2	5:25	53.3	10.6
19	6/29	6:00	31.1	20	4.0	4:43	71.6	14.3
20	6/30	6:30	30.5	11	2.2	19:35	81.6	16.3
21	7/2	9:30	30.0	26	5.2	7:13	71.6	14.3
22	7/2	7:00	29.4	12	2.4	9:06	81.6	16.3
		Mean	31.9+	26—	5.2—	6:36—	65.3—	13.1+
		Maximum	33.8	47	9.4	19:35	73.3	16.3
		Minimum	29.4	11	2.2	3:23	48.3	9.6

Simultaneous reading with No. 10 above of four immature fish in a land-locked pool.

P1	6/25	10:00	33.9	51	12.75	3:17	40.0	8.0
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TABLE II.

Respiration in Regard to Temperature Compared with that of Small Fish.

Rises per Fish Hour	Temperature in 5° intervals centigrade					
	16-20	21-25	26-30	31-35	36-40	
	—	—	4.2	3.6	8.4	—
	—	—	8.2	4.0	6.0	—
	—	—	5.2	8.0	5.8	—
	—	—	2.4	4.8	7.2	—
	—	—	—	9.4	4.6	—
Large fish in pen	—	—	—	9.2	2.4	—
	—	—	—	4.0	3.6	—
	—	—	—	2.2	3.6	—
	—	—	—	3.6	—	—
	—	—	—	3.2	—	—
Mean	—	—	5.0	5.2	—	—
Maximum	—	—	8.2	9.4	—	—
Minimum	—	—	2.4	2.2	—	—
Small fish (From Shlaifer & Breder, 1940)						
Mean	0.8	4.8	5.7	14.5	10.0	10.0
Maximum	0.8	10.4	9.6	22.3	10.8	10.8
Minimum	0.8	1.6	3.3	8.6	9.0	9.0

TABLE III.

Fishes Rising in Groups by Percent of Total.

No.	1	2	3	4	5	Total
1	100	0	0	0	0	18
2	100	0	0	0	0	16
3	100	0	0	0	0	42
4	93.5	6.65	0	0	0	30
5	93.1	6.9	0	0	0	29
6	100	0	0	0	0	36
7	100	0	0	0	0	23
8	100	0	0	0	0	18
9	100	0	0	0	0	20
10	95	5.0	0	0	0	40
11	100	0	0	0	0	12
12	100	0	0	0	0	24
13	100	0	0	0	0	47
14	100	0	0	0	0	18
15	100	0	0	0	0	18
16	95.65	4.35	0	0	0	46
17	100	0	0	0	0	21
18	100	0	0	0	0	41
19	100	0	0	0	0	21
20	100	0	0	0	0	11
21	100	0	0	0	0	26
22	100	0	0	0	0	12
Average	99.0—	1.0+	0	0	0	26—
Maximum	100	6.9	0	0	0	47
Minimum	93.1	0	0	0	0	11
Simultaneous reading with No. 10 above of 4 immature fish in a landlocked pool.						
P1	80.5	7.85	11.65	0	—	51